NAVAL SURFACE WARFARE CENTER,
SUBSONIC WIND TUNNEL BUILDING
(Naval Surface Warfare Center,
Buildings No. 7, 138, 139, 140 and 141)
Bounded to the south by the Clara
Barton Parkway and to the north and east
by MacArthur Boulevard
~~Bethesda vicinity~~ Silver Spring
Montgomery County
Maryland

HAER No. MD-118-A

HAER
MD,
16-SILSPR,
3A-

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
National Park Service
Northeast Region
Philadelphia Support Office
U.S. Custom House
200 Chestnut Street
Philadelphia, P.A. 19106

HAER MD, 16-SILSPR, 3A-

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Location: Bounded to the south by the Clara Barton Parkway and to the north and east by MacArthur Boulevard
~~Bethesda Vicinity~~ Silver Spring
Montgomery County
Maryland

USGS Falls Church, Virginia Quadrangle
Universal Transverse Mercator Coordinates:
18.309760.4316090

Date of Construction: 1943-1945

Engineer: Bureau of Yards and Docks, Navy Department
Architect: Bureau of Yards and Docks, Navy Department

Present Owner: U.S. Department of the Navy
Department of Defense

Present Use: Aviation Department

Significance: The Subsonic Wind Tunnel Building is an aviation testing facility contained within the Naval Surface Warfare Center (NSWC) Carderock Division Historic District. Naval Surface Warfare Center is associated with events that have made a significant contribution to the broad patterns of military technology. The research facilities at NSWC have provided the U.S. Navy with accurate, cost effective data on air and sea vehicle performance, and have made possible evaluative changes to improve performance, in advance of construction.

Project information: Under the 1995 round of Base Closure and Realignment (BRAC), research functions carried out at Naval Surface Warfare Center White Oak, Maryland will be relocated to Naval Surface Warfare Center Carderock Division. The Subsonic Wind Tunnel Building will be altered to accommodate these new functions. Documentation of this building to the standards of the Historic American Engineering Record prior to alteration was prescribed as a stipulation of a Memorandum of Agreement negotiated among the Maryland State Historic Preservation Officer and the Department of the Navy, and accepted by the Advisory Council on Historic Preservation. This documentation was undertaken in June and July 1995 in partial fulfillment of that agreement.

Geoffrey Eden Melhuish
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Architectural Description

The Subsonic Wind Tunnel Building is composed of a laboratory facility (Building 7), two 8 x 10 subsonic wind tunnels (Buildings 138 and 139) and a recirculating cooling system (Buildings 140 and 141). The Subsonic Wind Tunnel Building and the two subsonic wind tunnels were constructed in 1943. The recirculating cooling system was added to the wind tunnels in 1945.

Building 7, is a two story, poured concrete building faced in stucco. The structure adopts a T-shaped plan, measuring approximately 170 by 178 feet, and rises to a height of approximately 37 feet.[1] The building terminates in a flat roof with parapet. The interior of the building is divided functionally into three sections: the test room, a utility corridor, and an office area. Building 7 was constructed as a Wind Tunnel Facility, which still provides support to the one operational Subsonic Wind Tunnel (Building 138) located at the installation.

Building 7 rests on a concrete foundation with interior concrete load bearing walls and piers in the basement level. Both single-light fixed and paired four-light in-set hopper window units are incorporated within the building. All of the window units are original. A continuous concrete projection is found above the first and second story windows. The primary entry to the building is located on the east elevation. Paired, 5-light, metal-frame doors occupy the opening. This entrance is marked by a one-bay, three story extension of the primary block. The west elevation features a large metal overhead door leading to the test room. A single two-light metal door is located south of the overhead door within a window opening. The roof is accessed by a metal ladder located at the south side of the west elevation.

The interior of the building consists of an open, clear-span test room and partitioned utility corridor and office area. The open configuration of the test room was necessary to accommodate large equipment. The test chambers of the two wind tunnels occupy the northern and southern end of the building. A level of wood and metal decking extends along the northern and southern sides of the wind tunnels and provides access to the test chambers. The deck is accessed by way of a metal stairway. A simple metal railing surrounds each deck. The wind tunnels control rooms are located below the decks and defined by partition walls. Suspended fluorescent lights and fans have been added at the ceiling as has spray foam insulation.

The utility corridor occupies the central portion of the building. Access to the utility corridor is by way of a short flight of steps located on the east side of the test room. Constructed in a double loaded, central corridor plan, the north side of the utility corridor contains the generator room, a transformer room, and a heating room. A wash room and office are located on the south side of the corridor.

The east end of the building was originally an open shop. This area has been converted into office space utilizing a side hall plan. The hallway extends along the north half of the east elevation; frame walls were added to create offices on the west elevation. The south end of the east elevation also is used as office space.

The second floor is accessed by an open stairwell in the northeast corner of the building. The second floor utilizes a side-hall plan. Office areas are divided by frame partitions. Each space incorporates drop ceilings and fluorescent lighting units.

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[1] Wind Tunnel Building, Elevations, 10 October 1941.

The two, 8 x 10 subsonic wind tunnels (Buildings 138 and 139) are located along the north and south elevations at the rear of Building 7. Designed by the Bureau of Yards and Docks, these identical, general purpose wind tunnels are closed-throat, single return types with vented sections. The tunnels are welded steel construction with the test sections constructed in wood, for easy alterations. Air is driven through the tunnel by a sixteen-foot, four-bladed fan. Slots on the downstream side of the test section allow air to transfer between the wind tunnel and the outside environment. This vented section maintains the pressure of the wind tunnel equal to the outside environment. The majority of the tunnels circuits are located outside Building 7, which permits the temperature to be controlled by means of a recirculating water system.

The drive system for the north wind tunnel (Building 138), consists of a 1000 horsepower General Electric main drive induction motor, Model Number 8023325. The motor assembly is enclosed in a streamlined nacelle within the tunnel. The wind tunnel fan is mounted directly onto the motor shaft of the main drive. One General Electric variable speed motor generator set and one General Electric Constant speed motor generator set are located in the generator room of Building 7. The motor-generator sets absorb power lost from the fan motor and return the power into the system line. The generator room also houses the power factor regulator which adjusts to changes within the system and maintains constant speed necessary for accurate test results.[2]

The drive system for south wind tunnel (Building 139) varies only slightly from the north wind tunnel. The south tunnel is powered a 700 horsepower General Electric main drive induction motor rather than a 1000 horsepower unit. All other equipment, however, is identical to that found in the north wind tunnel, including the two motor generator sets located within the generator room.

Both subsonic wind tunnels feature a unique free-wheeling windmill located downstream from the fan assembly. The purpose of the windmill is to equalize the high pressure and low pressure systems of the airstream into one velocity, so accurate results can be achieved. Slots on each side of the wind tunnel test chamber allow air to be transferred between the wind tunnel and the outside. The transfer of air keeps the pressure within the tunnel and outside air constant.

Buildings 140 and 141 were added atop the subsonic wind tunnels in 1945 to control the increased temperature caused by the test fans and air friction upon the walls. Water contained in a poured concrete cistern located below each wind tunnel was pumped from the cistern to a network of metal pipes located on the outside of each tunnel. Spray heads located at the ends of the pipes diffused water on the exterior of the wind tunnel. Both evaporative cooling and the constant flow of water down the sides of the tunnel cooled the structure. Water was then collected in poured concrete catch basins found at the foot of each wind tunnel and drained back into the cistern for reuse.[3]

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[2] John Washko, Personal interview, 17 June 1996.

[3] John Washko, Personal interview, 17 June 1996.

History

The Subsonic Wind Tunnel Building at the Naval Surface Warfare Center Carderock Division was constructed in 1943 to augment the Navy's aeronautical research program. Rapid advancements in aerodynamics required more sophisticated and specialized testing facilities than those located at the Washington Navy Yard. On 17 March 1941, Congress authorized $500,000 for the construction of wind tunnels at Carderock, Maryland.

Since the facilities were the only wind tunnels within the Navy at the time, it was decided that the new wind tunnels would be of a general purpose type so that all branches of the U.S Navy could utilize them. Under the direction of Captain Walter S. Diehl with assistants R. H. Helmholz, J.N. Fresh, and R.H. Peterson, a one-sixth scale model tunnel was designed and tested to establish the geometrical and power details. When the model tunnel was accepted, the decision was made to construct two similar wind tunnels with 8-by-10 foot test sections and a laboratory.

Construction began in February 1942, according to designs by the Bureau of Yards and Docks in 1941. The new facility included a laboratory, a model shop, and two subsonic wind tunnels. The cost of construction of Building 7 was $482,774 and the combined cost of the twin subsonic wind tunnels was $268,413. The 1000 horsepower tunnel was first operated on 21 September and the 700-horsepower tunnel was in service about a week later. On 21 April 1944, the first tests were conducted on parachutes. Further testing of scale model aircraft and airborne equipment enabled the laboratory to predict the performance of full scale designs and modify existing equipment.

Major modifications have been made to the Subsonic Wind Tunnel Building since its construction. In 1954, a portion of the return passage was altered to permit testing on Vertical/Short Takeoff and Landings (V/STOL) models at low forward and transitional speeds. The second major change occurred in 1955 when Building 163 was constructed south of Building 139 to house a Carter Denver Booster Pump. The purpose of the pump was to introduce forced air into the wind tunnel chamber to increase test speeds. The final change occurred during the 1960s when the open shop area located in the east section of Building 7 was partitioned into the current office space.

HAER recordation of the Subsonic Wind Tunnel Building was undertaken in anticipation of its adaptive reuse for new activities moving to the installation as a result of the 1995 Base Closure and Realignment Act.

SOURCE OF INFORMATION/BIBLIOGRAPHY

A. Engineering Drawings:

Drawings In the collection Naval Surface Warfare Center Carderock Division, Bethesda, Maryland:

1941, October 10. Wind Tunnel Building, First Floor Plan. One sheet. Bureau of Yards and Docks.

1941, October 10. Wind Tunnel Building, Elevations. Thirty sheets. Bureau of Yards and Docks.

1941, September 4. Wind Tunnel, Framing Plan Top and Bottom. Seven sheets. Bureau of Yards and Docks.

1941, September 4. Wind Tunnel, Elevations E-E to H-H and Sections. Seven sheets. Bureau of Yards and Docks.

Drawings In the collection of the National Archives and Records Administration. Archives II - Cartographic Branch. Records of the United States Navy, Bureau of Yards and Docks. Record Group 71. 1941-1942 Microfilm list, Historical Plans. Roll 506, Carderock Model Testing Basin.

1941, October 16. Wind Tunnel Building, Plot, Foundation, & Roof Plans. One sheet. Bureau of Yards and Docks.

1941, October 16. Wind Tunnel Building, Second Floor Plan. Thirty sheets. Bureau of Yards and Docks.

1941, October 16. Wind Tunnel Building, Sections, Jamb, & Details. Thirty sheets. Bureau of Yards and Docks.

1941, October 16. Wind Tunnel Building, Plumbing. Thirty sheets. Bureau of Yards and Docks.

1941, October 1. Wind Tunnel, Elevations A-A & B-B and Sections. Seven sheets. Bureau of Yards and Docks.

B. Historic Views (All historic views courtesy of Naval Surface Warfare Center Carderock Division, Bethesda, Maryland):

View southwest of Subsonic Wind Tunnel Building. 1943.

View northeast of Subsonic Wind Tunnel Fan. 1957.

C. Interviews:

Washko, John (Supervisor Mechanical Engineer Technician). Interview by Geoffrey E. Melhuish, 17 June 1996. Transcript, Naval Surface Warfare Center Carderock Division, Bethesda, Maryland.